United States Department of Agriculture	**Forest Service**	**Wallowa-Whitman National Forest**	**La Grande Ranger District** **3502 Highway 30** **La Grande, OR 97850**

Date: 9/14/2020

Subject: Sheep – Fire/Fuels Effects

To: Brianna Carollo

Introduction

A century of wildfire suppression and exclusion, grazing, and extensive timber harvesting have interacted to alter the structure, composition, and disturbance regimes within the project area. The forested stands within the project area lack a large tree component and are now much denser and uniform in their composition. These density changes have contributed significantly in shifting disturbance regimes toward less frequent, but larger and more severe disturbance events. These conditions put large portions of the project area at high risk for an uncharacteristically large and severe wildfire.

The purpose and need for this project represented by the difference or "gap" between the existing condition and the desired condition based on Forest Plan management direction. The following needs have been identified:

1. to restore, maintain and promote spatial and temporal forest structural and compositional conditions reflective of natural resilient ranges of variation across the landscape.

2 to promote vegetation and fuels conditions across the project area that provide increased opportunities to utilize fire from both planned and unplanned ignitions to restore appropriate fire regimes and reduce potential for wildfire impacts to private lands.

Cohesive Wildland Fire Management Strategy (National Strategy)

The National Cohesive Wildland Fire Management Strategy is a collaborative process with active involvement of all levels of government and non-governmental organizations, as well as the public, to seek national, all-lands solutions to wildland fire management issue.The objectives of the treatments within the Sheep project are tiered to the goals identified within this National Strategy. Those goals are:

1. Restore and maintain landscapes so that all jurisdictions are resilient to fire related disturbances in accordance with management objectives.
2. Create fire-adapted communities so people and infrastructure can withstand a wildfire without loss of life or property.
3. Improve wildfire response so all jurisdictions participate in making and implementing safe, effective, efficient risk-based wildfire management decisions.

Potential wildland fire operational delineations (PODs)

A basic principle of risk management is to anticipate problems one may face down the road. Doing so can help reduce time, pressure, and uncertainty as well as expand options for a safer and more effective response.

PODs are polygons whose boundary or potential control lines (PCL) are relevant to fire control operations (e.g. roads, ridgetops, natural or manmade openings which are not readily ignitable). PODs are useful for summarizing wildfire risk and planning strategic response to unplanned ignitions accordingly. In an operational response context, PODs can be used to guide choices of where to construct or hold fire line as well as where to conduct burnout operations. PODs may also prove useful for strategic fuels planning, with potential treatment opportunities within PODs.

Defensive Fuels Profile Zones (DFPZs) are the treated areas adjacent PCLs. DFPZS provide treated areas that disrupt or alter fire progression and or enhance suppression opportunities. They are not designed to stop fires burning under extreme conditions during the peak of a burn period. They are designed to provide suppression forces a higher probability of successfully managing fire when environmental conditions moderate and are more conducive for suppression activities.

Creation of DFPZ adjacent to a potential control line is a proactive approach to affect fire behavior in anticipation of a future wildfire. It also provides fire mangers the ability to analyze the ecological and environmental tradeoffs of fire line locations and the associated fuels reduction activities prior to an actual fire.

DFPZs would be created by:

1. Reducing surface fuel loads.
2. Increasing crown base heights.
3. Reducing canopy densities through "thinning from below" treatments.
4. Retaining the largest healthiest trees to create shade and moderate wind speed.

Scientific Principles of Fire Behavior (*Table 1*)		
Principle	**Effect**	**Advantage**
Reduce surface fuel loads	Reduces potential flame length/fire intensity	Increases fire suppression opportunities and probability of success
Increase crown base heights	Requires longer flame length to initiate torching	Reduced probability of torching
Reduce canopy density	Makes tree to tree crown fire less probable	Reduced crown fire potential.
Retain larger trees	Thicker bark and higher crowns	Moderates wind speed and shades surface fuels

The effectiveness of the DFPZ depends not only its design characteristics (size, location and type of treatment) but also on the behavior of fires approaching it. Spotting distance from torching trees is also a major factor in determining the width of a DFPZ. Fire behavior modeling has shown that spotting distance up to ½ mile can be expected under large fire environmental conditions. Fire behavior is strongly influenced by fuel spatial pattern in the adjacent areas. Consequently, natural barriers and past fuel treatments in adjacent lands would help determine fuel break width and canopy alteration.

Focus Areas for Treatments

The fuels treatments proposed within this analysis would be strategically located in locations where fire control lines have the highest probably of success. Treatments would also be located and designed to create a modified fuels bed adjacent to private property which would decrease the potential transmission of wildfire from public to private land.

Blue Springs WUI and project areas within 1 mile of private land

The area in and adjacent to Blue Spring WUI and adjacent to the Vey Ranch has been a focal point for fuels reduction treatments for the last 10 years. There is a need to maintain and/or improve these treatments. Treatments would be focused on:

- Forest Service roads 51, 5155, 5160, and 5178 are the primary access /egress routes for the WUI. Fuels treatments along those road systems will be designed to increase public and firefighter safety.
- Dense mixed conifer stands with heavy accumulations of dead and down material within a mile of the WUI.
- Creating a DFPZ along the boundary between public and private owned land.

Strategic placed fuels break along roads systems and ridges.

Potential control lines would be identified and reinforced with fuels reduction treatments anchored into the existing road system and reinforced by natural barriers, wildfire scars, and/or past vegetative treatments. These treatments would not be designed to stop a wildfire by themselves but would provide suppression forces a higher probability of successfully attacking a wildfire with indirect suppression tactics such as "burn outs". These fuels breaks would be utilized to limit fire size by compartmentalizing the project area and creating PODs. Compartmentalization of the project area would increase opportunities for future planned and unplanned fire.
Treatments would be focused on stands adjacent to forest service roads 51, 5175, 5175-030, 5182, 5184 and 5185.

Forested stands which are outside of their Historical Range of Variability (HRV)

The objective of these treatments is to move stand structure and condition toward a more resilient and sustainable forest under current and future conditions. Natural disturbance regimes within the project area have been altered for over 100 years. Widespread anthropogenic changes in the drier stands within this project have created more homogenized conditions generally in the form of large, dense, multilayer patches of fire intolerant tree species. Treatments would be designed to:

- Restore stand resilience to fire and other disturbance factors.
- Increase the abundance/health of fire tolerant tree species (western larch, Douglas fir and ponderosa pine).
- Control density and species composition of the regeneration in stands with past harvest activities.
- Reintroduce fire as a disturbance mechanism and maintenance tool by utilizing planned and unplanned fire where appropriate.

EFFECTS ANALYSIS

This analysis addresses the effects of implementing the proposed alternatives for the Sheep Creek project area in relation to the key issue "reducing fire behavior potential in strategic locations".

Key Issue for Sheep Creek

Reducing fire behavior potential in strategic locations is a key issue identified during project development, and is responds to Purpose and Need statement four:

> ***The departure of current vegetation and fuels conditions and associated fire regimes from expected natural conditions indicate a need to promote vegetation and fuels conditions across the project area that provide increased opportunities to utilize fire from both planned and unplanned ignitions to restore appropriate fire regimes and reduce potential for wildfire impacts to private lands*.**

Indicators for the key issue of fire behavior potential:

1. ***Fire Behavior Characteristics*–** The following measures compare how each alternative reduces fire behavior potential on public land, especially as they relate to DFPZs and PCLs, thus reducing the risk of wildfire impacts to private lands.

    ***Size of a fire in acres one hour after igniton* –** A relative measure to compare wildfire spread rates.

    ***Fire Rate of Spread* –** Distance a fire will spread in one hour. Used to compare fire espread rates.

    ***Fire Flame Length* –** The length of the flame in a spreading fire within the flamimg front. Measure of fire intensity. Used to compare fire intensity between Alternatives.

    ***Fire Type* –** Suface or Crown. Measure of crown fire potential.

2. ***Canopy Characteristics* –** The following measures compare how each alternative modifies the fire type

    ***Crowning Index* –** Relative measure which shows the likelyhood for fire to spread through the canopy.

    ***Torching Index* -** Relative measure which shows the likelyhood for trees to torch.

    ***Basal Area* –** is the average amount of an area (acre) occupied by tree stems. It is defined as the total cross-sectional area of the tree trumks in a stand measured at breast height, and expressed as square feet per acre.

    ***Canopy Base Height* -** The lowest height above the ground at which there is a sufficient amount of camopy fuel to propagate fire vertically into the canopy.

Other Indicators and Measures

3. ***Air Quality***

    Smoke Emissions – Amount of smoke released into the air from prescribed burning

4. ***Large Diameter Trees***

Growth Potential – Relative measure of how large trees can benefit from treatment

5. ***Surface Fuels***

    Moisture – 1 and 10 hour fuels

    Temperatures – Surface affected by direct sunlight

    Levels – Fuel load

6. ***Fire Regime Condition Class***

    Acres restored to historic ranges

7. ***Fuel Profiles in Defensible Spaces***

    Acres treated along primary control lines, defensible fuels profile zones, and potential operational delineation

Desired Condition - The desired condition would be to restore and maintain an ecosystem that thrives with regular wildfire disturbance. Uncharacteristically large and severe wildfire would be rare. The creation and maintenance of the DFPZs would provide fire managers strategically sound locations to manage fire from which decreases the risk to private property and the Blue Springs WUI.

Desired Conditions within DFPZs - Post Treatment (*Table 4*)

Modeling Group	Surface Fuel by Size Class (tons/ac)			Canopy Characteristics		Fire Behavior Characteristics			
	0 - ¼”	¼”- 1”	1 – 3”	Basal Area	Canopy Base Height	Rate of Spread (Ch/Hr.)	Flame Length (Feet)	Fire Type	Fire Size in 1 Hour (Acre)
1	.2	.9	1	< 75	>15	< 10	< 4	Surface	< 2
2 and 3	1	2.2	3.6	<100	>10	< 5	< 2	Surface	< 1

Method of Analysis

Fire behavior modeling and observed fire behavior from past wildfires within or near the project area were used to predict both existing and post treatment fire behavior. Environmental inputs for modeling were obtained from weather records at J-Ridge RAWS. Fuels Management Analyst Suite (Carlton, 2016) was used to make fire behavior predictions. The fuel models used in this analysis are from Scott and Burgan’s “Standard Fire Behavior Fuel Models” (RMRS-GTR-153, June 2005). Detailed data and results are located in the project file.

Fire Behavior Modeling Groups**:** The stands within the project area were grouped into three modeling groups based on PVG, surface fuel loadings, crown fuel characteristics and potential fire behavior. Field inventory was completed on representative stands within each of the modeling groups to gather surface and crown fuel data. This data was then extrapolated to all the stands within each of the modeling groups and input into fire behavior models. The following table displays stand characteristics for each modeling group.

(***Table 2***)

Modeling Group	**PVG**	**Species description**	**Fire Regime**	**FCCS Fuel Bed**
1	Dry Upland Forest	Ponderosa pine - Douglas fir	1	1518
2	Moist Upland Forest	Grand fir- Douglas fir	3	1542
3	Cold Upland Forest	Lodgepole – western larch	4	1590

Modeling Group 1 Stand Characteristics: lower elevation/south facing slopes that contain a mix of Ponderosa Pine and Douglas dominate in the overstory with lodgepole and grand fir dominating in the regeneration layer,

Modeling Group 2 Stand Characteristics*:* mixed conifer stands with an overstory comprised of grand fir, Douglas fir and western larch. Grand fir dominates the regeneration layer.

Modeling Group 3 Stand Characteristics*:* Subalpine fir and lodgepole stands in the higher elevations and cold drainages of the project area. Lodgepole dominates in the understory.

The fire behavior modeling results show how each of the alternatives would change both surface and crown fire behavior within the project area. It is important to note the modeling results are used to compare alternatives and are not intended to be precise predictions of what would occur. The following fire behavior and smoke emissions modeling programs were used in this analysis:

- Fuels Management Analyst Suite was used to make fire behavior predictions.
- IFTDSS used to help establish existing conditions.
- Fuels Characteristic Classification System (FCCS) was used to make fire behavior predictions and visualizations.
- LANDFIRE Data was used to determine existing fuels beds for the project area.
- Fire Behavior Observations from the Tower, Chicken Hill and Boundary wildfires.
- Blue Sky Playground to estimate smoke emissions from prescribed burning for the action alternatives.
- BEHAVE Plus used to compare surface fire behavior characteristics between alternatives

Alternative Summary

Alternative 1

No actions are proposed under this alternative.

Alternative 2 (modified proposed action)

This alternative reduces fire behavior potential by modifying surface fuels, ladder fuels and crown fuels with a combination of commercial and non-commercial treatments. These modifications

- Create PODs, PCLs and DFPZs in priority locations
- Promote firefighter safety by expanding suppression and egress options along existing road systems
- Increase opportunities to use wildfire for ecological benefit where the Forest Plan permits.
- Maintain or move forested stands towards their Historical Range of Variability (HRV) and encourage the growth of large and fire resilient trees

Alternative 3

Alternative three shares many of the same treatments as the proposed action, however, this alternative responds to comments made during the scoping period and eliminates the following from the proposed action:

- All temp roads and closed roads to be reopened.
- Treatments in OFMS stands.
- All treatments in moist and cold forests which aren't in strategic fuels breaks.
- All commercial RHCA treatments.

DIRECT AND INDIRECT EFFECTS FROM TREATMENT TO FIRE BEHAVIOR POTENTIAL

ALTERNATIVE 1

The "No action" alternative would result in no reduction in fire behavior within the identified strategic locations.

Potential Fire Behavior

Lack of pre-suppression fuels reduction treatments designed to create DFPZs limit suppression opportunities and decrease the probability of success. Without the development of PODs encompassed by PCLs fire managers would continue to be reactive to wildfire and lose the ability to fully analyze the ecological and environmental tradeoffs of fire line locations prior to an actual fire.

Potential Fire Behavior with Implementation of Alternative 1 ***(Table 3)***

Fire Behavior Characteristics		Modeling Groups		
		1	**2**	**3**
Canopy Characteristics	Basal Area	96	172	159
	Canopy Base Heights	1	6	5
	Crowning Index	39	26	40
	Torching Index	0	0	0
Resultant Fire Behavior	Rate of Spread (ch/hr)	43	56	40
	Fire Flame Length (ft)	44	60	38
	Fire size 1 hour after ignition (acres)	76	125	63
	Fire Type	Passive Crown	Passive Crown	Passive Crown

Reference Fire Behavior Appendix for Detailed Information

Effects to Large Diameter TreesEffects to Surface Fuels Levels, Moisture and Temperatures

Multi-layered stand structures, tree densities and live vegetation would continue to grow while surface fuels continue to accumulate. High tree densities would also increase the susceptibility of the stands to insects and disease, resulting in increased surface fuel loading.

Effects to Air Quality

Because no actions are proposed, Alternative 1 would have no direct effects to smoke emissions. Biomass would continue to accumulate, increasing the potential for the release of large amounts of emission during wildfire. Wildfires tend to occur at the driest time of the year, fuels are more completely consumed and typically produce three to five times more emissions than early or late season prescribed fires.

Direct and Indirect effects of Alternative 1 are:

1. High potential for wildfire transmission from public to private lands.
2. Suppression options continue to be limited due to lack of functional DFPZs.
3. Lack of predetermined PCLs and DFPZs reduces the ability to compartmentalize wildfire.
4. Risk of damaging impacts to soil, vegetation and watersheds from high intensity/severity wildfire remain high.
5. Costs of wildfire suppression continues to increase due to limited pre-suppression planning.
6. Decrease in forest resistance to fire, drought, and disease from increasing density of trees.
7. Lack of safe access for suppression resources due to heavy fuel loading adjacent to road systems.
8. High probability that fire brands from torching trees will cross fire lines due to low canopy base heights and high surface fuel loads adjacent to control lines.
9. Landscape resiliency to future disturbance remains low.
10. Stand structure and function move further from historical range of variability. Fire intolerant tree species continue to be overrepresented in dry forest.

Summary
This alternative does not meet the purpose and need of this project. Fire behavior would not be modified in strategic locations to create PODs with PCLs and DFPZs. The stands adjacent to private property would readily transmit wildfire from public to private lands. Lack of DFPZs would place firefighters at risk and would increase the potential for an uncharacteristic large and severe wildfire. Lack of pre-suppression planning and compartmentalization (PODs) of the project area would reduce fire manager's options to utilize confine and contain suppression strategies when appropriate conditions exist.

The deferral of the proposed treatments increases the departure of fire adapted ecosystems from their range of historic conditions. Fire intolerant tree species would continue to be overrepresented in dry forest types. Aggressive wildfire suppression would continue allowing surface, ladder and crown to accumulate to hazardous levels. Tree densities and surface fuels would continue to accumulate creating conditions that allow fire to easily move vertically from the forest floor into the canopy. The potential for an uncharacteristic crown fire would continue to increase.

ALTERNATIVE 2

Alternative Two treatments are designed to:

- To actively manage surface, ladder, and crown fuels in the Blue Springs Wildland Urban Interface (WUI) and adjacent to private property.
- To create potential wildland fire operational delineations (PODs) with the potential control lines (PCLs) identified and reinforced by fuels reduction treatments. These activities would decrease fire behavior potential in critical areas and allow fire to resume its ecologic function on the landscape.
- To restore and promote forest structural and compositional conditions reflective of historical ranges of variation (HRV).
- To enhance landscape resilience to future wildfire, insect and disease risk.

Alternative 2 identifies strategic locations for potential fire control lines and reduces fire behavior potential in the adjacent stands by implementing a combination of harvest, thinning, pruning, burning and mechanical surface fuel reduction treatments. These proactive treatments would not be designed to stop a wildfire by themselves but would provide suppression forces a higher probability of successfully containing a wildfire with indirect suppression tactics such as “burn outs”. These potential control lines and associated fuels treatments would compartmentalize the project area and create potential operational delineations (PODs) which would increase opportunities to utilize for both planned and unplanned fire.

A surface fire may make the transition to some form of crown fire depending on the surface fire intensity and canopy characteristics (*Van Wagner1977 and 1993*). Fuel reduction treatments including prescribed fire, mechanical thinning, mastication and pile burning, are designed to reduce fire behavior potential by removing surface fuels, increasing the height of the canopy and reducing canopy fuels while retaining large fire–resistant trees *(E.L Kalies, L.L Yocum Kent / Forest Ecology and Management 375, 2016).* The treatments proposed in alternative 2 modify vegetative structure and fuel loadings to reduce wildfire behavior, increase firefighter and public safety, and improve landscape resiliency.

Accessibility is also important component to managing fires. Many wildfires which burn large acreage or prescribed fires that escape do so because firefighting equipment and personnel cannot reach areas of concern in a timely manner. Most of the potential control lines and fuels treatments proposed are on or adjacent to existing roadbeds. The road maintenance associated with these activities would improve firefighter's response times and provide safe access and egress from a fire if needed.

Mechanical Fuels Treatments

Commercial thinning or improvement cuts, precommercial thinning, mastication and piling are examples of mechanical fuels treatments. All thinning treatments would be followed by prescribed fire and/or mechanical treatments to reduce surface fuels to the desired levels thereby reducing the intensity of potential wildfires. Research has shown that thinning (removing ladder fuels and decreasing tree crown density) followed by prescribed fire or other mechanical treatments that reduce surface fuel amounts will reduce the intensity of wildfires *(Graham, McCaffery and Jain. 2004. RMRS-GTR-120).* The proposed commercial thinning followed up with surface fuel treatments would reduce canopy bulk density and increase canopy base heights thus reducing the potential for crown fire (*Cruz et al. 2002, Rothermel 1991, Scott and Reinhart 2001, van Wagner 1977).*

Effects to Potential Fire Behavior with Implementation of Alternative 2

Many of the forested stands within the project area have not experienced fire or thinning for several decades. Thinning combined with prescribed-fire or other surface fuels treatments is necessary to effectively reduce potential fire behavior and crown fire hazard *(PNW-GTR-628).* All modeling groups underwent a ladder/crown fuel reduction treatment and a post-harvest treatment to reduce surface fuel loadings. FMA+ was updated with the post treatment stand conditions and fuel bed characteristics and then ran utilizing identical environmental parameters used for alternative 1.

Potential Fire Behavior with Implementation of Alternative 2 (Table 6)

Fire Behavior Characteristics		**Modeling Groups**		
		1	**2**	**3**
Canopy Characteristics	Basal Area	60	88	72
	Canopy Base Heights	20	14	6
	Crowning Index	75	51	75
	Torching Index	213	326	124
Resultant Fire Behavior	Rate of Spread (ch/hr)	5	3	3
	Fire Flame Length (ft)	2.4	1.5	1.5
	Fire size 1 hour after ignition (acres)	1	.3	.3
	Fire Type	Surface	Surface	Surface

Reference Fire Behavior Appendix for Detailed Information

Effects to Large Diameter Trees - Treatments would protect and enhance the growth of the remaining large fire-resistant trees. Thinning treatments would be designed to leave the largest/healthiest trees on site to provide shading of surface fuels and partial sheltering surface wind speeds *(Albini and Baughman, 1979).*

Effects of Thinning Treatments on Surface Fuels Levels - The proposed thinning would create a short-term increase in fine fuel loadings (3 inch minus size classes) immediately following activities. These fine fuel loadings are expected to range from 5 - 10 tons per acre. Fire hazards immediately following activities are not severely elevated due to the green nature of the slash. Depending on the weather, the slash could cure rapidly and present a short-term (several months) elevated risk in the late summer before fall rains/snows arrive. A curing period is required to achieve desired fuel consumption when prescribed burning. Fuel loadings generally are compacted closer to the ground by winter snowpack (reducing the potential for crown fire), and after a period of drying in the late spring/early summer they are generally ready for prescribed burning. Therefore, if the fuels reduction treatment takes place within the year following harvest, there is a short term (3 month) period of elevated potential for high intensity burning conditions in the event of a wildfire during this period. This occurrence depends largely on weather conditions and the relatively low potential for an ignition in that exact same area. This risk would be immediately reduced following the completion of the activity. Should the slash reduction be delayed this risk would remain in place for the hottest four months each summer for a 2 year period after which the fine fuels will be on the ground and decomposed to the point that they are no longer a flash fire hazard.

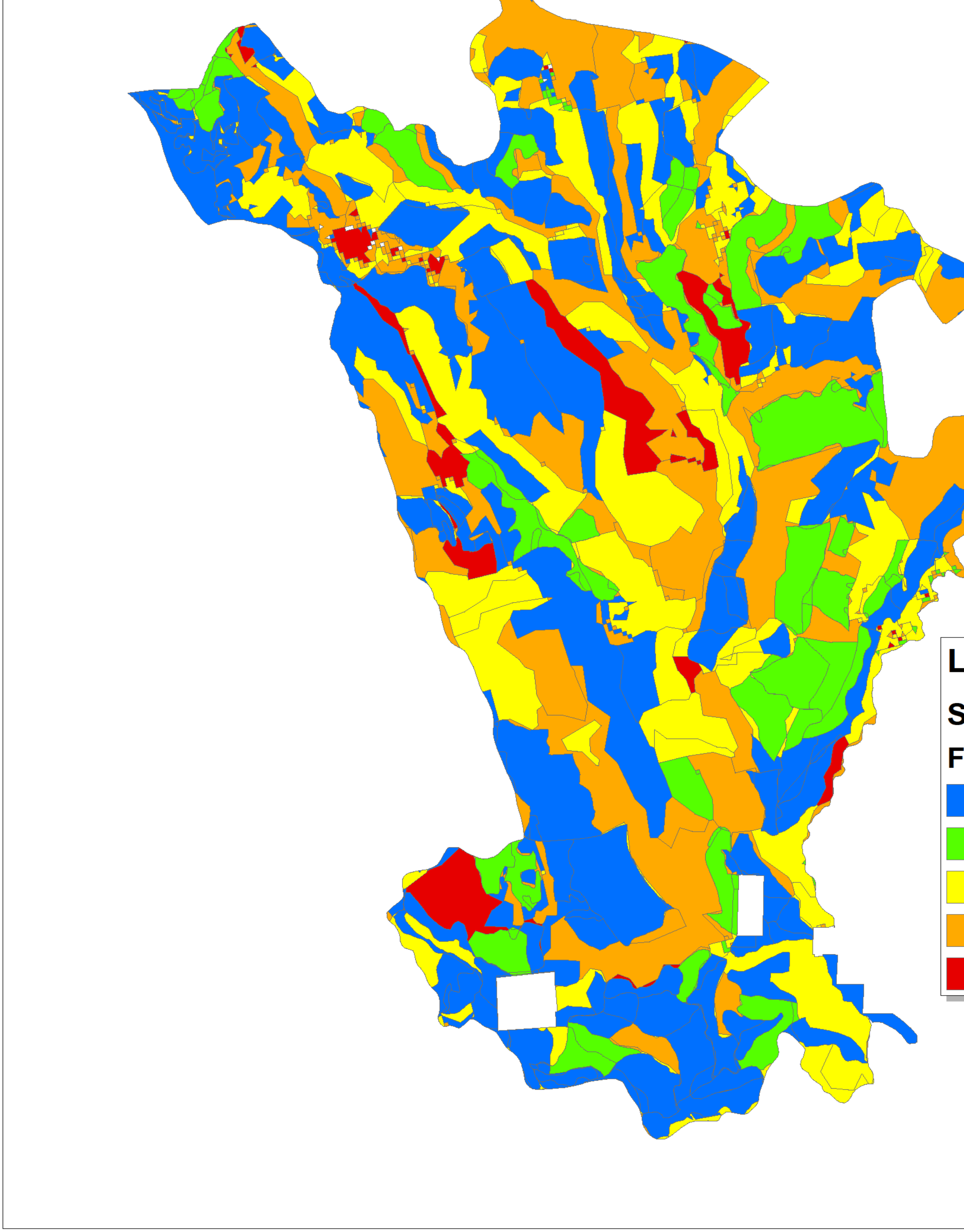
Effects of Thinning on Surface Fuels Moisture – Research has shown that surface fuel moisture differences between thinned and unthinned stands were not significant and occurring only for large diameter woody fuels in the early season, when fuel moisture values are typically high and fire danger is low (*Estes, Knapp, Skinner and Uzoh, International Journal of Wildland Fire, 2012, 21, pg 428-435). Faiella and Bailey (2007)* found no significant difference in fuel moisture of 1 hour and 10 hour fuels between unthinned and thinned stands. Any effect from thinning on fuel moisture levels is likely to be greater following precipitation events when fuel moisture levels are high, possibly due to how thinning influences interception of the rain or snow by the canopy. The decreased canopy closure as a result of thinning means that less precipitation is intercepted by the canopy in thinned stands, allowing for more rain and snow to the forest floor. The long hot and dry summers which occur in eastern Oregon have a much larger effect on fuel moisture than the canopy cover. Fuel moisture differences resulting from the proposed treatments would therefore not be expected to substantially influence fire behavior during times of the highest fire danger.

Effects of Thinning on Wind Speed and Surface Fuel Temperatures – Thinning may slightly increase surface wind speeds and the added sunlight may cause local increases to surface fuel temperatures, both of which can potentially influence fire behavior in terms of fire rates of spread. However, any enhancing effect on wind speeds and surface fuels temperatures due to thinning will be offset by the reduction in ladder and crown fuels, if the surface fuels/slash is adequately treated (Weatherspoon 1996; Agee and Skinner 2005).

Proposed treatments are not likely to reduce surface fuels shelter. Fire behavior modeling was conducted utilizing partially sheltered wind speed adjustment factors (RMRS-GTR-266, 2012) for post treatment stand comparisons. This modeling showed there was not a significant difference in predicted fire behavior due to the slight increase in mid-flame wind speeds. Reference the project folder for fire behavior modeling.

Prescribed Fire Treatments

Prescribed fires are an effective means to reduce surface fuels, thin suppressed overstocked regeneration and increase canopy base height. These management ignited fires are implemented when fuel moistures are moderate, spring or late fall, and generally burn with lower intensity than wildfires. Because prescribed fires are less intense and less severe than most wildfires, they are less likely to damage soils



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Direct and Indirect effects of Alternative 2

1. The proposed treatments reduce surface, ladder and crown fuels thus reducing potential fire behavior.
2. The creation of DFPZs adjacent to PCLs in strategically sound locations to initiate suppression operations, increasing the probability of success.
3. Creation of a functional DFPZs adjacent to the boundary decreases risks to private property.
4. Reduction of surface and ladder fuels increases prescribed burning opportunities by reduces risk of escape.
5. Reduced wildfire intensity decreases the risk of damaging impacts to soil, vegetation, watersheds, and visuals.
6. Increased forest resistance to fire, drought, and disease from decreased density of trees.
7. The proposed road maintenance would improve wildfire initial attack response times and increase firefighter safety by improving access routes.
8. Mechanical treatments would decrease the amount of pollutants generated during a prescribed burn or wildfire. Less intense fires would produce less smoke.
9. Reduced probability that fire brands from torching trees will cross fire lines constructed in DFPZs.
10. Reduces tree densities to desired levels and increases the percentage of fire tolerant trees species. Moves stand structure and composition towards HRV.
11. Sets up the landscape so unplanned fire used for ecosystem benefits would become a viable option for fire managers.

Summary: Alternative 2 meets the purpose and need of this project by reducing potential fire behavior in strategic locations. PODs with PCLs and DFPZs would be created using a combination of thinning, pruning, mechanical surface fuel reduction treatments. The DFPZs constructed adjacent to roads and the associated road maintenance would improve firefighter's response times and provide safe egress from a fire if needed. DFPZs would also decrease the potential for a wildfire to escape on to private property or onto the WUI.

Compartmentalization of the project area would provide fire managers with options to utilize confine and contain suppression strategies on wildfires when appropriate. Completed DFPZs would help facilitate the use of both planned and unplanned fire within and adjacent to the project area.

One of the most common fire suppression containment tactics is the use of a controlled backfire ignited from a control line. Preparing for a successful backfire requires reducing surface, ladder and crown fuels prior to ignition. The effectiveness of a containment line is increased when there is sufficient time to complete the fuels reduction treatments prior to ignition. Treatments completed under this alterative would identify potential fire control lines and then reinforce them by creating a defensive fuels profile zone directly adjacent to them. This proactive strategy would increase the probability of successfully containing or managing a fire.
The proposed treatments would also meet the purpose and need by moving fire adapted ecosystems in the drier portions of the project area towards their range of historic conditions. Treatments would be designed to increase the percentage of fire tolerant tree species such as ponderosa pine, western larch and Douglas fir. Fire would be reintroduced into the project area, surface fuel loadings would decrease, and the gap in vegetation profiles between historical conditions and current conditions would decrease.

ALTERNATIVE 3
Many of the treatments in this alternative are identical to the proposed action and will produce the same effects as described under Alternative 2. The following changes were made to the proposed action to address concerns raised during the scoping period.

- drop all temp roads and closed roads to be reopened.
- drop treatments in moist and cold forests which aren't in strategic fuels breaks.
- drop commercial RHCA treatments.
- restrict access on the 5182-500 loop road.

Mechanical Fuels Reduction Treatments

Commercial thinning, precommercial thinning, mastication, grapple piling and hand piling are the mechanical treatments proposed within Alternative 3. There is 7457 acres of mechanical treatments designed to reduce surface, ladder and crown fuel loading in this alternative.

Effects to Fire Behavior Characteristics – Many of the treatments in Alternative 3 are the same as what was identified in the proposed action. These stands would have the same fire behavior and effects modeled under Alternative 2 (refer to table 6). Stands deferred from treatment consideration under this alternative would have the same fire behavior and effects that was modeled under Alternative 1 (refer to table 3). The deferral of treatments in critical locations within the proposed strategical fuels breaks would decrease their effectiveness.

Effects on Large Diameter Trees – Treatments in this alternative would protect and enhance the growth of the remaining large fire-resistant trees. Thinning treatments would be designed to leave the largest/healthiest trees on site to provide shading of surface fuels and sheltering of surface wind speeds. There are 94 acres of OFMS treatments deigned to move stands into OFSS condition in this Alterative. The remaining 395 acres of OFMS deferred from treatment under this alternative would still have abundant ladder fuels and a heavy surface fuel loading. This places the remaining larger diameter trees at risk to an uncharacteristically severe fire.

Effects on Surface Fuels Levels, Moisture, and Temperatures – The proposed treatment activities for Alternative 3 will reduce surface fuels characteristics to the desired levels (refer to table 4) identical to alternative 2. There is a 4,430 acre decrease in the number of acres of surface fuel reduction treatments under alternative 3. The deferral of these treatment areas will leave areas with higher than desired surface and crown few loadings. These untreated areas have the potential to produce fire behavior that is uncharacteristic.

Prescribed Fire Treatments

Prescribed fires are an effective means to reduce surface fuels, thin suppressed overstocked regeneration and increase canopy base height. There is 9521 acres (identical to alternative 2) of natural fuels burning proposed under this alternative. However, due to the deferral of proposed action treatments units under Alternative 3, there will be a reduction of 3303 acres of activity generated slash burning.

Effects on Air Quality – Emissions generated from prescribed fire under this alternative could create noticeable smoke impacts to local communities and forest visitors, but air quality would remain within the requirements of the Clean Air Act. Prescribed fire managers will need to carefully select areas to be burned that optimize natural smoke dispersion and minimize local exposure to adverse smoke impacts. The following table displays the estimated emission from prescribed fire treatments in Alternative 3.

Projected emissions from Alt 3 Prescribed Fire Treatments in tons *(Table 7)*

Emission	Activity Fuels	Natural Fuels	Grapple Pile	Hand Pile	Total
Acres Burned	1322	9521	3398	2866	**17,107**
PM10	292	1428	717		
PM2.5	252	1238	614		
CO2	33309	147290	152141		
Green House Gasses (GHG's)	39687	179,661	162019		

Maintenance of treatments – Identical to Alternative 2, the effectiveness of the completed treatments will diminish as time passes. Many of the completed treatments will require some form of maintenance to keep the treated stands within the desired condition. Fire (planned and unplanned) will eventually be the primary maintenance tool for many of the treated stands but it is anticipated that additional mechanical treatments will be needed as well.

Direct and Indirect effects of Alternative 3:

1. The strategic fuels break located on west side of the project area adjacent to the 5160-030 road would only be partially completed. The deferral of treatments (41, 42, 43, 47, 48, 49, 88, 95, 100, 102, 103, 108, 123, 223, 335 and 350) would diminish the effectiveness DFPZs by reducing the opportunities for suppression resources to anchor into preexisting fuels treatments.
2. Wildfire intensity and severity continue increase in stands that were deferred from treatment. The risk of damaging impacts to soil, vegetation and visuals would go unmitigated.
3. Decreased forest resistance to fire, drought, and disease from the high density of trees in untreated stands.
4. Deferral of treatment units (9, 64, 61, 65, 68, 70, 72, 77, 90, 92, 96, 99, 101, 106, 107, 125, 218, 242, 243, 244, 338 and 367) decreases the width of the fuels break adjacent to forest service roads 5182 and 5184. Lack of treatment in these stands increases the probability that fire brands from torching trees will be carried across control lines.
5. Lack of a fully completed DFPZs alters and/or delays fire suppression response actions. This delay may lead to increased fire size and suppression cost, and places firefighters at greater risk due to increased exposure.
6. The old forest stands identified for treatment within the proposed action have stand structures (abundant ladder fuels with high canopy bulk density) and surface fuel loadings that would support high intensity crown fire. Alternative 3 eliminates 395 acres of treatments in the OFMS which leaves areas within the proposed the fuels breaks with a high potential for crown fire.
7. Deferral of treatment units (4, 5, 11, 24-29, 31,114, 115, 206, 207, and 361) place the adjacent private property at risk to wildfire. The lack of a fully implemented DFPZ along private boundary decreases fire suppression opportunities on public land and increases the potential for the loss of resources on private lands.

Summary: The proposed fuels treatment in Alternative 3 reduce surface and crown fuels thus reducing the probability of a crown fire initiated within portions of the proposed strategic fuels break. However, deferral of 4430 acres of treatments that reduce fire behavior to desired levels would leave areas adjacent to the PCLs with moderate to high crown fire potential from a wildfire. The strategic fuels break treatments designed in the propose action were part of a proactive approach to address wildfire concerns. Many of planned proactive treatments would be moved to more reactive actions completed by fire incident management teams after a large wildfire has been established.

ALTERNATIVE SUMMARY COMPARISON

Key Indicator #1 - Acres of treatments that maintain or improve fire regime condition class

Treatments which improved or maintain condition class (Ac)	Proposed Actions	Alternative 1	Alternative 2	Alternative 3
	6521	0	6521	4885

Key Indicator #2 - Acres of Fuels Reduction Treatments

Fuels reduction treatments (Ac)	Proposed Actions	Alternative 1	Alternative 2	Alternative 3
	11,486	0	11,887	7457

Key Indicator #3 - Fire Behavior Potential

Modeling Group	Fire Behavior Characteristic	Alternative	
		1	**2 and 3**
1	Fire Rate of Spread (chains/hr)	43	5
	Fire Flame Length (feet)	44	2.4
	Fire Type	Passive Crown	Surface
	Fire size 1 hour after ignition (ac)	76	1
	Crowning Index	39	75
2	Fire Rate of Spread (chains/hr)	56	3
	Fire Flame Length (feet)	60	1.5
	Fire Type	Passive Crown	Surface
	Fire size 1 hour after ignition (ac)	125	.3
	Crowning Index	26	51
3	Fire Rate of Spread (chains/hr)	40	3
	Fire Flame Length (feet)	38	1.5
	Fire Type	Passive Crown	Surface
	Fire size 1 hour after ignition (ac)	63	.3
	Crowning Index	40	75
Alternative two and three treatment designs are similar to each other and will produce similar fire behavior.			

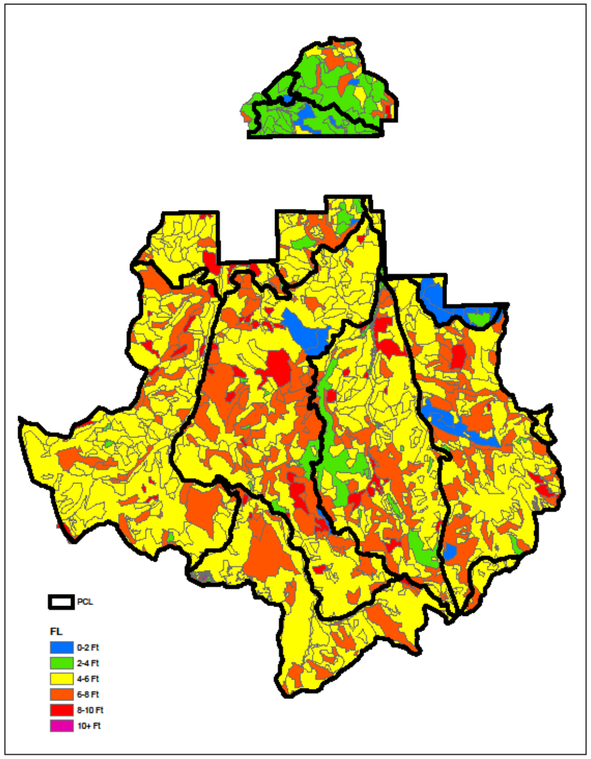
(Table 14) Alternative Summary Comparison.

	Alt 1	Alt 2	Alt 3
Crowning Index/Crown Fire Potential	Crown fire Potential remains high due to the low canopy base heights, high crown fuel loadings and abundant ladder fuels.	Crown fire potential is decreased due to increased canopy base heights; reduce crown fuel loadings and the elimination of ladder fuels.	The deferral of treatment units under this alternative leaves critical areas within the proposed DFPZs with higher than desired crown fuel loadings.
Torching Index	The potential for torching remains high due to the low canopy base heights, high crown fuel loadings and abundant ladder fuels.	Torching potential is decreased due to high canopy base heights; reduce crown fuel loadings and the elimination of ladder fuels.	The deferral of treatment under this alternative leaves critical areas within the proposed DFPZs with a high potential for torching.
Fire Rate of Spread	Rate of fire spread exceeds production rates of initial attack crews in strategically critical locations.	Rate of fire spread is reduced to a level that suppression crews can effectively and safely utilize the predetermined fire control lines.	Deferral of treatment units leaves critical areas within the proposed DFPZs with higher than desired fire rates of spread. A substantial amount of work would need to occur adjacent to the PCL prior to utilization.
Fire Flame Lengths	Flame lengths and fire intensity limit options for suppression resources throughout the project area.	Flame length and fire intensity reduced in DFPZs to levels which provide multiple options for suppression resources.	Deferral of treatment units leaves critical areas within the proposed DFPZs with higher than desired flame lengths.
Canopy Base Heights	Canopy base heights remain low. Trees have a high potential to torch. Crown fire potential remains high.	Canopy base heights are increased within the DFPZs and crown fire potential is reduced.	Deferral of treatment units leaves critical areas within the proposed DFPZs with low canopy base heights and the potential for a crown fire is high.

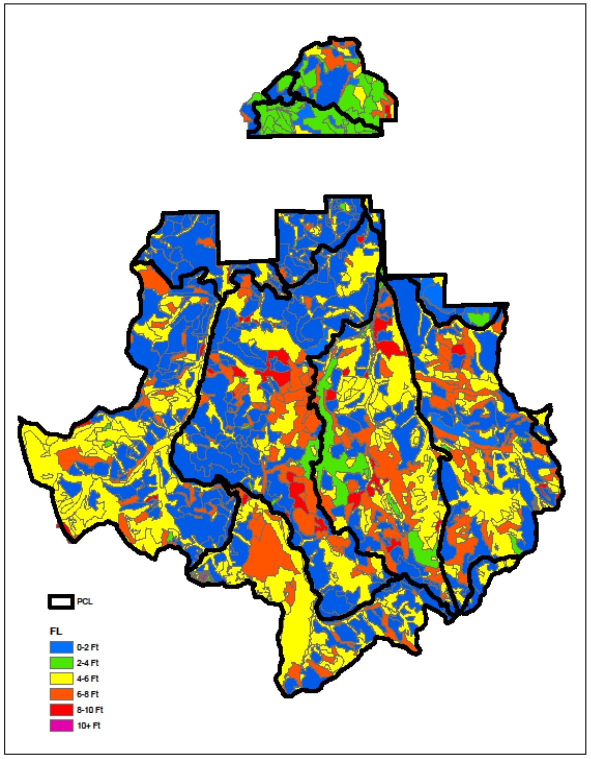
	Alt 1	Alt 2	Alt 3
Air Quality/ Emissions from Fire	No prescribed fire emissions. Wildfire fires would generate large amounts of emissions due fire size and availability of fuels.	The mechanical treatments which reduce biomass would decrease the amount of pollutants generated during a prescribed burn or wildfire. Smaller less intense fires would produce less smoke.	Reduction in treatment acres reduces the amount of prescribed fire emissions. Partial completion of the proposed DFPZs increases potential for larger wildfires which generate larger amounts of emissions.
Potential Control Lines	Fire control lines have not been identified or analyzed. All prep work adjacent to control lines would be deferred until the wildfire occurs. Reactive approach to fire management.	Fire control lines have been identified, analyzed and reinforced with DFPZs in strategic locations. Proactive approach to fire management.	Fire control lines have been identified and analyzed but only partially reinforced with DFPZs in strategic locations.
Defensive Fuels Profile Zones	No DFPZs created. These conditions will continue to limit firefighting opportunities, pose undesirable risk to private property, firefighter and public safety.	Firefighting opportunities are increased, risk to private property, firefighter and public safety are reduced. DFPZs have been created to reduce spread rates in critical locations.	Deferral of treatment units leaves critical areas within the proposed DFPZs with higher than desired flame lengths and increases the potential for a wildfire to escape initial attack.
PODs or Compartmentalization of the project area	Lack of pre-suppression planning or compartmentalization of the project area exist, wildfires have a high potential to spread throughout project area. WUI and private property are at risk from wildfire.	Suppression strategies are based on predetermined control lines and reinforced by adjacent fuels treatments. Compartmentalization of the project area decreases wildfire size; reducing risk to private property and WUI's. Creates a DFPZ along road systems.	Compartmentalization and the proposed pre-suppression planning would be partially completed. Deferral of treatment units would create gaps in the DFPZs and leave portions of the identified potential control lines untreated and vulnerable.
Prescribed Fire	Lack of PCLs, PODs and DFPZs increases the risk of escape and decrease opportunities to utilize natural ignitions for resource benefit. Areas with high fuels loadings produce undesired effects.	The use of fire (planned and unplanned) would increase with the utilization of the constructed PCLs and DFPZs. Reduce risk of escape and reduce fuel loadings lengthens burn windows.	The use of fire (planned and unplanned) would increase within the areas that had completed PCLs and DFPZs. Lack of completed treatments increase the risk of escape decrease burn opportunities.

The following fire behavior maps were created using data from FMA+, stand exams, the Fuel and Characteristic Classification System (FCCS). The maps display the associated fire behavior relationship to the Potential Control Lines for each alterative upon completion PCLs and the adjacent surface fire flame lengths and rates of spread for alternative 1, 2 and 3 upon completion of the proposed mechanical treatments.

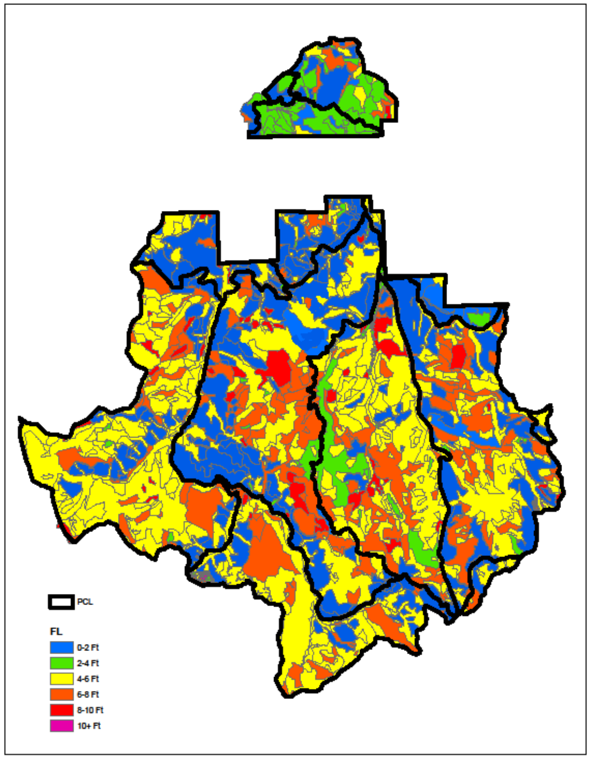
Alt 1 - Flame Length

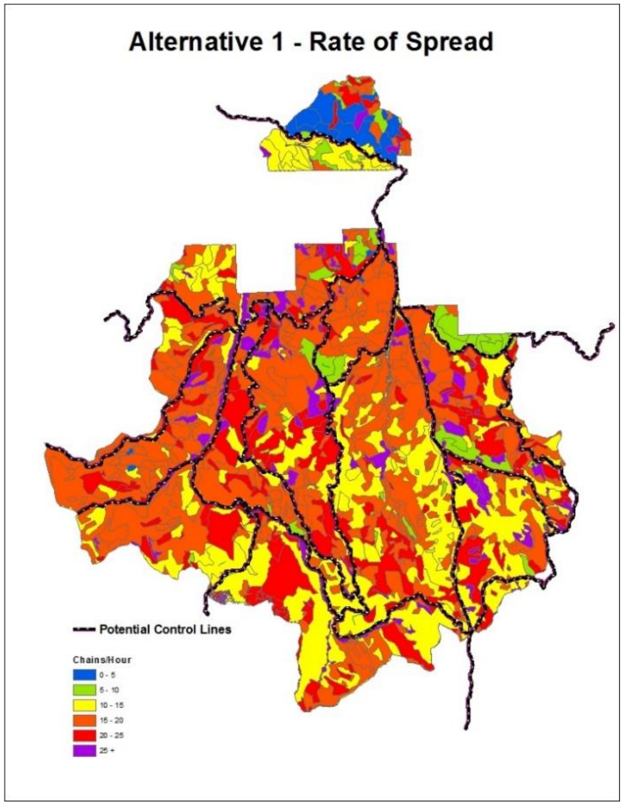


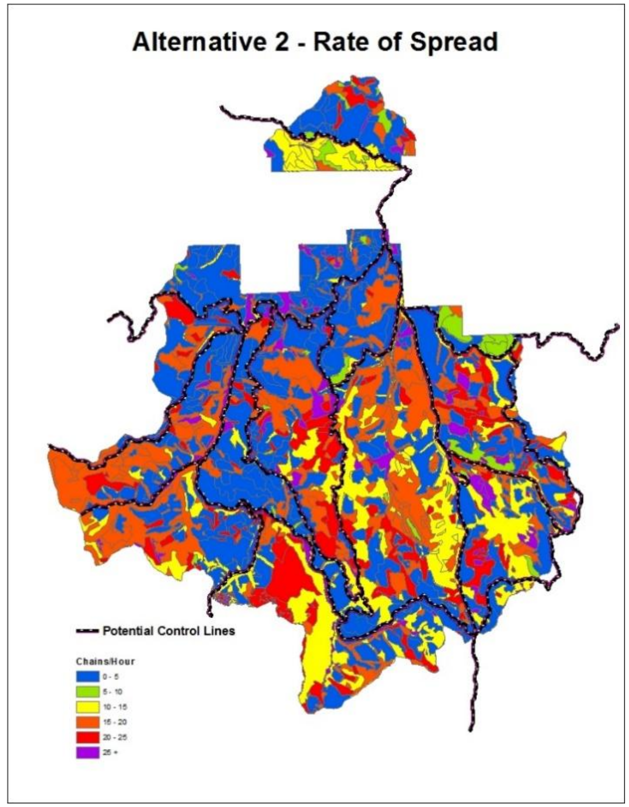
Alt 2 - Flame Length

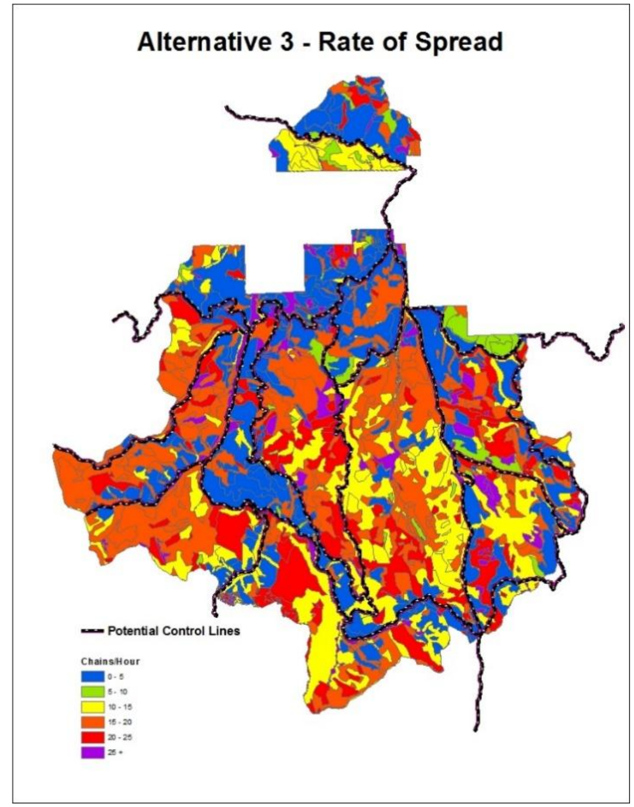


Alt 3 - Flame Length




Alternative 1 - Rate of Spread
Potential Control Lines
Chains/Hour
0 - 5
5 - 10
10 - 15
15 - 20
20 - 25
25 +


Alternative 2 - Rate of Spread
Potential Control Lines
Chains/Hour
0 - 5
5 - 10
10 - 15
15 - 20
20 - 25
25 +


Alternative 3 - Rate of Spread
Potential Control Lines
Chains/Hour
0 - 5
5 - 10
10 - 15
15 - 20
20 - 25
25 +

Cumulative Effects

Fire Behavior Potential

The proposed treatments within this assessment along with ongoing and proposed treatments on private and adjacent National Forest would reduce the potential for a large, high intensity wildfire in the Upper Grand Ronde watershed. Suppression resources would have a higher probability of successfully containing a wildfire on public lands. Wildfires would burn with reduce fire intensity at a decreased size and would require less resources for containment. These resources could be utilized in higher priority areas during times of increased need.

Air Quality

Smoke emissions during the spring and fall months primarily result from Federal and private landowners prescribed fire activities. Federal land managers in northeast Oregon coordinate and manage the cumulative effects of prescribed burning on public land. Private landowners are required to follow the advice of the Department's smoke management forecaster when burning.

The smoke producing activities proposed in this project combined with all the other smoke generating activities throughout northeast Oregon would generate smoke that may have the potential to effect air quality in the Grande Ronde and Baker valleys. Coordination with ODF Smoke Management prior to burning will be required to ensure air quality objectives under the Clean Air Act are met.

Wildfire is a primary source of unintentional carbon emissions from forests in western United States (Stephens 2005). Other emission concerns include agricultural burning and home heating in local communities. Both wildfires and agricultural burning typically occur mid- to late-summer and are not expected to impact air quality at the time prescribed fire activities are planned. However, home heating with fuel wood and industrial slash pile burning occur in the fall and winter months and will produce additional emissions concurrent with prescribed fire.

Climate Change and Fire

Climate change is expected to alter vegetation structure and composition, terrestrial ecosystem processes, and the delivery of ecosystem services in the Blue Mountains. Climate influences the spatial distribution of major vegetation biomes, abundance of species and communities within biomes, biotic interactions, and geographic ranges of individual species. Climate also influences disturbance processes that shape vegetation structure and composition, which are often the catalysts for vegetation change. However, there is considerable uncertainty in what the actual effects on vegetation owing to climate change could be (JE Halofsky, DL Peterson, PNW-GTR-939, 2017).

Increased temperatures with climate change will likely lead to increased wildfire area burned (Littell et al. 2010, McKenzie et al. 2004, Westerling et al. 2006). With increasing fire in forested ecosystems, managing vegetation to reduce fire severity and decrease fire patch size could help to protect fire refugia and maintain old trees (Peterson et al. 2011). For example, incorporating openings in silvicultural prescriptions decreases forest density and fuel continuity, which may reduce wildfire severity and protect old trees (Churchill et al. 2013, Stine et al. 2014) (table 6.8a). Management practices that help fire to play a more natural role in ecosystems, such as density management, prescribed fire, and wildland fire use, may also increase ecosystem resilience to wildfire under a changing climate (Peterson et al. 2011, Stephens et al. 2010, Stine et al. 2014).

Ecological disturbance (e.g., fire, insect, and disease outbreaks), which is expected to increase in a warmer climate, will be extremely important in affecting species distribution, tree age, and forest structure, facilitating transitions to new combinations of species and vegetation patterns. Mountain pine beetle may be particularly important in lodgepole and ponderosa pine forests, and western spruce budworm and Douglas-fir tussock moth may also increase periodically. Annual area burned by wildfire is expected to increase substantially, and fire seasons will likely lengthen. In dry forest types where fire has not occurred for several decades, crown fires may result in high tree mortality. In addition, the interaction of multiple disturbances and stressors will create or exacerbate stress complexes. For example, an extended warm and dry period may increase bark beetle activity, which would increase short-term fine fuels. Considerable uncertainty exists about how climate change will affect species distribution, forest productivity, and ecological disturbance in the Blue Mountains. Simulation models provide science-based projections of how a warmer climate could modify the growth environment of species and broad patterns of ecological disturbance, supplemented by studies of the paleoecology of the region. However, because the future climate may differ considerably from what has been observed in the past, it is difficult to project vegetative response accurately for specific locations and time periods.

Greenhouse Gas Emissions - Climate change is a global issue that results from global Greenhouse Gas (GHG) emissions. From a quantitative perspective, there are no dominating sources and fewer sources that would even be close to dominating total GHG emissions. The global climate change issue is the result of numerous and varied sources, each of what might seem to make a relatively small addition to global atmospheric GHG concentrations. The Council on Environmental Quality recommends that environmental documents reflect this global context and be realistic in focusing on ensuring that useful information is provided to decision makers for actions that the agency finds are a significant source of GHGs.

While it is well documented that human activities have added greenhouse gases to the atmosphere, mainly through the burning of fossil fuels and clearing of forests, the activities proposed in this project were designed with adaptation strategies (actions that help ecosystems accommodate changes adaptively) and mitigation strategies (actions that enable ecosystems to reduce anthropogenic influences on global climate, *Milar, 2007*).

All action alternatives manage the forest ecosystem so that it is better able to accommodate climate change and to respond adaptively as environmental changes accrue. The action alternatives encourage gradual adaption to change to a warmer and drier environment by favoring disease and fire resistant trees, reducing stand density, and lowering fuel loadings. This would reduce the potential for catastrophic conversion due to climate change driven disturbance factors that are forecasted.

Adaptive strategies included within the treatment design:

1. Resistance options – manage forest ecosystems and resources so that they are better able to resist the influence of climate change or to stall undesired effects of change.

2. Promote resilience to change – resilient forests are those that not only accommodate gradual changes related to climate but tend to return toward a prior condition after disturbance either naturally or with management assistance. Promoting resilience is the most commonly suggested adaptive option discussed in a climate-change context (Dale et al. 2001, Price and Neville 2003, Spittlehouse and Stewart 2003). Forest management techniques such as prescribed burning or thinning dense forest, can make forest more resilient to wildfire and decrease GHG emissions.

3. Enable forest to respond to change – This group of adaptation options intentionally accommodates change rather than resist it, with a goal of enabling or facilitating forest ecosystems to respond adaptively as environmental changes occur (Milar, 2007).

The following are mitigations strategies incorporated into treatment design:

1. Restore healthy forest so that carbon can be efficiently stored in live trees

2. Reduce GHG emissions by reducing surface fuel loadings.

3. Ensure stands are stocked with trees at levels that are appropriate for site conditions. One means of slowing the release of sequestered carbon is to increase forest resistance to fire, drought, and disease, by reducing the density of small trees *(Stephens and Moghaddas, 2005).*